STUDY OF MAGNETIC MOTIONS IN THE SOLAR PHOTOSPHERE AND THEIR IMPLICATIONS FOR HEATING THE SOLAR ATMOSPHERE

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Study of Magnetic Structure in the Solar Photosphere and Chromosphere

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Dynamic modeling of CO line formation

Observations of the CO fundamental rotation-vibration lines around 4.67 μm obtained in the context of this grant by Noyes and Uitenbroek have provided rich details of the dynamics of the solar temperature minimum. Motivated by these observations Avrett, Höflich, and Uitenbroek have started to model the dynamic formation of CO lines in the solar atmosphere. Their hydrodynamic models take account of the time-dependent chemical formation and destruction of CO molecules, and the radiative transfer in the lines. Preliminary results (published in the Proceedings of the 9th Cambridge Workshop on Cool Stars, Florence Oct 1995) show that the formation time scales of the CO molecule are such that an almost stationary concentration of CO is maintained, nothwithstanding the passing of acoustic shock fronts. An important consequence of this behavior is that intensity variations in the CO line cores reflect local variations in temperature rather than shifts in optical depth, and are thus reliable indicators of the properties of waves that pass through the atmosphere.

Multi-dimensional radiative transfer

Uitenbroek has finished his development of a two-dimensional radiative transfer code that includes the effects of partial frequency redistribution (PRD). A paper describing the new code is being prepared. The code will be an important tool in the modeling of solar atmospheric inhomogeneities as we have explained in our proposal. It is working very well; convergence has been achieved without problems in standard solar atmosphere models with different atomic models. These include hydrogen, with Lyα and β treated with PRD, and Ca II and Mg II with the H&K and h&k lines respectively treated with PRD. All these lines are important chromospheric diagnostics of which detailed observations exist so that comparisons between calculated and observed line profales can be made.